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BEAR CREEK INTAKE TOWER REMOVAL

BC, CANADA

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Klohn Crippen Berger
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500 – 2955 Virtual Way
Vancouver, BC
604.669.3800
www.klohn.com

CONTACT NAME	Sahar Pakzad
EMAIL	spakzad@klohn.com
TEL	604.251.8590
PROJECT NAME	Bear Creek Intake Tower Removal
LOCATION OF PROJECT	Vancouver Island, BC, Canada
YEAR COMPLETED	2019
CATEGORY OF ENTRY	C. Water Resources
ROLE IN PROJECT	Prime Consultant
PROJECT OWNER / CLIENT	BC Hydro
PROJECT SUMMARY	BC Hydro required the removal of a deteriorating intake tower in the Bear Creek Dam Reservoir on Vancouver Island. Klohn Crippen Berger+Hatch (KCB+H) produced a demolition plan and drawings for the safe removal of the tower by helicopter, designed rigging attachment points, rigging requirements for lifting via helicopter, and prepared drawings and specifications for the permanent plugging of the intakes with tremie concrete. The project transformed the reservoir into a safer and more aesthetic recreational area.

INNOVATION

The Bear Creek Dam Reservoir is the upstream storage reservoir for the Jordan River Project on Vancouver Island. Constructed in the 1970s, the reservoir was designed as an as-needed water supply for the downstream Jordan River Diversion Dam and Powerhouse. Water released from the Bear Creek Reservoir was controlled through a low-level outlet.

In the 1980s, BC Hydro determined that Bear Creek Dam would fail during a moderate earthquake. The reservoir level was permanently lowered such that, if it failed, the amount of water released would not jeopardize the safety of the downstream Jordan River Diversion Dam. The overflow spillway was deepened to maintain the lower reservoir level, and the low-level outlet was discontinued.

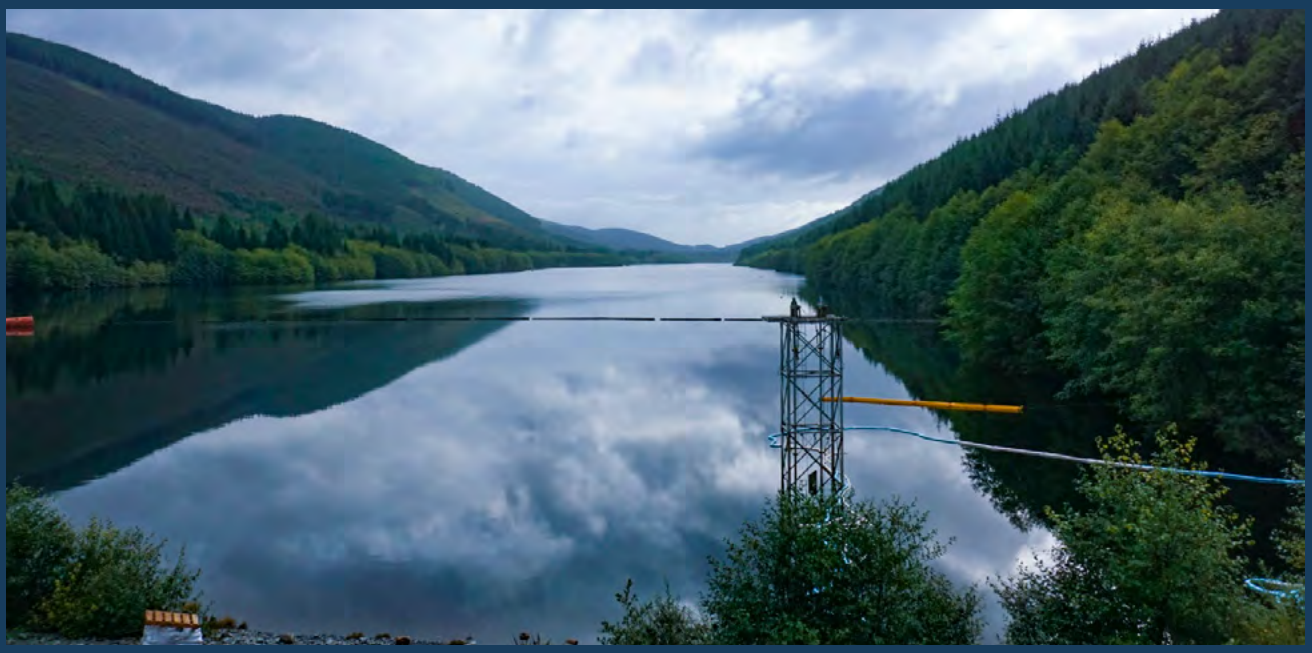
KCB+H was engaged by BC Hydro in 2017 to develop a plan for eliminating the public risk around the intake tower. Proposed alternatives included:

- removing the intake tower above the water level and installing a lower platform;
- implementing preventative measures to restrict climbing of the tower; or
- completely removing the tower from the reservoir.

Each alternative was evaluated with regards to safety, environmental impact, cost and long-term viability. Ultimately, it was decided to completely remove the tower from the reservoir to eliminate the safety risk to the public and any future concerns from the deteriorating tower.

The project's main objective was to produce a demolition plan and drawings to safely remove the tower from the Bear Creek Reservoir by helicopter. KCB+H's role included designing rigging attachment points to the tower, rigging requirements for lifting via helicopter, and providing a construction sequencing and safe working procedures for removal of the tower. KCB also prepared drawings and specifications for the permanent plugging of the intake structure with tremie concrete, which included working with the contractor and concrete suppliers on methods to place the concrete to minimize environmental impact. KCB+H was on site for the duration of construction to monitor progress and provide quality assurance.

Communication and timing were important throughout the construction to ensure the tower was safely removed. Contractors climbed onto the tower and dismantled the operation building before fastening the helicopter rigging to the top of the tower. Specialized divers cut the base of the tower legs from the foundation using an underwater torch. KCB+H specified exactly how the base plates were to be cut so that the tower would remain stable while the helicopter rigging was prepared.



COMPLEXITY

Bear Creek Reservoir is not easily accessible by conventional ground transportation, which increased the project's complexity and required the use of specialized mobile equipment and unique construction methods.

The intake tower was too heavy for a locally sourced helicopter to lift all at once. Using historical drawings from the original construction of the tower, KCB+H determined optimal weights for removing the tower with multiple helicopter lifts. For each helicopter lift, custom-engineered rigging attachments were designed to safely connect the tower to the helicopter and help move the tower to a safe laydown yard for dismantling. KCB+H worked with the helicopter contractor to ensure the overall rigging and operation details during lifting and flight were controlled so that demands imposed on the vulnerable tower were minimized.

Once the tower was successfully removed from the reservoir, the underwater intakes were permanently sealed. Procuring a cost-effective and appropriate concrete mixer-pumping equipment for underwater pouring was a challenge. The remote location and difficult access prevented local concrete suppliers from sourcing the concrete from local batch plants. KCB+H worked with a concrete supplier to source an acceptable product for underwater tremie concrete pours that could be batched on site. A local contractor was consulted to establish the methods for placing the concrete with the use of a mobile concrete mixer-pump. Preliminary trials for placing the concrete were performed on dry land to confirm and finalize the construction details. In the end, the concrete was successfully placed from the reservoir shoreline and poured to seal the intakes.

SOCIAL AND/OR ECONOMIC BENEFITS

The Bear Creek Reservoir Intake Tower Removal Project eliminated the public safety risk associated with the deteriorating intake tower. The low-level intake structure was permanently sealed preventing any future uncontrolled release of water that could jeopardize the safety of the public and the integrity of the environment downstream Jordan River Diversion Dam.

ENVIRONMENTAL BENEFITS

Environmental monitoring and mitigating measures were used to minimize potential concrete plumes under water and eliminate environmental impacts to the reservoir. A silt curtain was installed in the reservoir surrounding the intake tower and structure to ensure any disturbed silt and sediment was contained while the work was taking place. The pH level and turbidity of the reservoir water were continuously monitored to ensure that levels remained within regulatory limits.

BC Hydro together with Pacheedaht First Nation managed the environmental monitoring throughout the construction phase. Regulatory agencies were informed of the project progress through meetings held regularly and well in advance of approval application submission dates.

MEETING CLIENT'S NEEDS

Significant planning, communication, and coordination was required amongst KCB+H, BC Hydro, and a team of contractors, including underwater divers and helicopter operators, to ensure that BC Hydro's exceptional standard of safety was upheld during the design and execution stages of the project.

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